International Commission for the Northwest Atlantic Fisheries

Serial No. 5026
(D.c.3)

ICNAF Res.Doc. 77/VI/7

ANNUAL MEETING - JUNE 1977

Assessment of the Flemish Cap redfish fishery

by

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Abstract

The state of the redfish fishery in Division 3M (Flemish Cap) is assessed. Using a modified production model, values of 16,000 tons of maximum sustainable yield were obtained for the stock. It was found that the drastic reduction of standardized CPUE in 1966-1967 was preceded by the greater values of fishing effort and that in some cases it did not correspond with catch peaks. A TAC of 16,000 tons is suggested, supported by the increasing trend in CPUE, whose average reaches values slightly over the one existing at the beginning of the fishery.

Introduction

The state of Flemish Cap redfish fisheries (Div. 3M) has been analyzed by Parsons and Parsons (1974, 1976a and 1976b). There are three reported redfish species on the Flemish Cap grounds, so far, *Sebastes marinus*, *Sebastes mentella* and *Sebastes fasciatus*, their relative abundances being unknown, although it has been partially determined that the least abundant is *S. fasciatus* (Templeman, 1976).

From the research vessel catches made in sampling surveys by Canada and USSR, it has been determined that the greatest share of the catch is *S. mentella* (Parsons and Parsons, 1976a).

It is not possible to assess the proportion of each species in the catch from the infromation available in the Sampling Yearbooks or the Statistical Bulletins as the data on redfish catch are not broken down by species.

The present paper gives an assessment of the redfish fishery using a production model to obtain estimates of sustainable yield at different exploitation levels, by considering the three species comprising the catch as a single stock.

Materials and Methods

Since 1956 approximately, different countries, members of ICNAF, have operated in the Flemish Cap ground, catching the predominant species in the division and among them, redfish.

The catch and effort data were obtained from the Statistical Bulletin for the 1956-1975 period and the Circular Letters for the year 1976 (preliminary data) broken down by country, month and vessel tonnage class.

Effort Standardization

Since 1956 different national fleets with vessels of various tonnage classes have fished in Div. 3M, having a variable activity each year and during the period under consideration (1956-1976).

It was impossible to standardize the fishing effort in Flemish Cap from the reported data in country, month, year and vessel tonnage class on the basis of a criteria involving any determined country. Because of this, vessels were grouped by tonnage classes without considering the country.

The analysis of the data so treated showed that for the first 11 years in the fishery history, the dominant tonnage calss was 151-500 tons, while the bulk of the catch in the periods 1956-1958 and 1972-1976 was taken by vessels of >1,800 and >2,000 tons respectively.

The method used was to plot the CPUE (tons per days fished) of the vessels from the tonnage class of 151-500 tons *vs* the tonnage class of >1,800 up to 1972, and the vessels of 151-499.9 tons *vs* the ones in the >2,000 tonage class for years 1972-1976 and using as a premise that they should have fished more than 50% of redfish with respect to their total catch. A conversion factor of 1.0 was assumed for the computations due to the small variations in tonnage in the categories by ICNAF since 1972 with respect to the former ones.

A straight line passing through the origin was fitted to the points from each vessel tonnage class, and its slope was used as a conversion factor to find the equivalence of the effort in any vessel tonnage class to standard class (>1,800 tons) (Fig. 1). The equivalent days fished so found were added to obtain the total number of standard days of both categories. The redfish catches were then added to find the catch per standard days fished.

Trends in Catch, Effort and Catch per Unit Effort

The redfish fishery in the Flemish Cap grounds started in 1956 when it was reported a total catch of 13,000 tons by the vessels fishing on the ground. The catch peak in 1958 when it reached over 54,000 tons, decreasing to 7,000 tons in years 1962 and 1963. In 1964 and 1965 the catch rose up to 17,600 and 23,400 tons respectively, to drop down to 700 tons in 1967, the lowest value recorded in the history series. In the 1968-71 period the catch remained around the average of 5,000 tons, rising abruptly in 1972 and 1973 over 22,300 and 34,600 tons respectively, while in the years 1975 and 1976 the catch remained around 16,000 tons under quota regulation (Fig. 2).

The trend in fishing effort, expressed in days fished, behaves similarly to the catch. The two maximum peaks in fishing effort were in the years 1959 and 1965, in coincidence with the maximum catch values.

These maxima were of 3,183 and 3,556 days fished for the >1,800 ton vessel tonnage class.

The high redfish catches reached in these years were due to the considerable fishing effort on the area at that time, which probably caused a decrease in the abundance and hence the following values of CPUE, expressed in tons per standard days fished (>1,800).

The CPUE had its peaks in 1958 and 1972, in coincidence with maximum catches in both cases.

During the 1960-1970 period, the CPUE levels were low, less than 13 tons per day fished, with minima in 1966 and 1967, years which were preceded by the greatest values of fishing effort in the historic series analyzed without corresponding with the greater catch value (Fig. 2).

Yield-Effort Relationship

The Schaefer (1954) production model assuming an equilibrium state in the fishery, was applied using the modifications of Gulland (1961). This modification consists in averaging the fishing effort over a series of years, equal to the number of fully recruited year-classes in the fishery, because in the practice the fisheries are established and developed in conditions far from equilibrium due to the changes in the level of fishing effort and the particular conditions of each exploited fish stock.

To take into account these effects the effort was averaged over 6 and 8 years in the relations of CPUE *vs* effort and was applied t o the method of Walter (1975) to correct the errors introduced by not considering the non-equilibrium state of the fishery.

Linear regressions were computed, relating the catch per days fished to the fishing effort averaged over 6 and 8 years for the redfish in Div. 3M (Fig. 3) and were converted to the parabolas of equilibrium catch *vs* fishing effort (Fig. 4). The results obtained are showen in Table 1.

Discussion

The results obtained in this paper should be taken as preliminary, as the production model, as the one used here, only relate the total production and the stock, and they do not consider the possible changes in recruitment and so in the stock, although determining the level effort corresponding to a maximum sustainable yield implies an associated fishing mortality which could be far or near from the level of a fishing mortality that at least do not contribute to the decreasing of the population at the end of the year with respect to the beginning, in which case the stock would have limited possibilities of recovering itself.

The behaviour of catch, effort and CPUE has not been very close to the theoretical equilibrium values given by the model with the exception of years 1975 and 1976 in which the values are on the curve.

The average catch for the first five years of the period under study and for the last five years gives the figures 32,500 and 26,200 tons respectively, but it should be pointed out that the years 1975 and 1976 which are included in the present analysis are under the effects of a quota regulation. The same analysis and subperiods for the historic series considered, shows that the value of fishing effort for the last five years (1,300 days fished) was smaller than the figure for the first five years of the fishery (1,800 days fished), strengthening the evidence that the average catch has been affected by the quota regulation. It should be added that the values found for the CPUE in the same subperiods show an increasing trend in opposition to the values found for the first five years of the fishery.

From the model, in years 1958, 1959, 1973 and 1974, the redfish catch was considerably higher than the equilibrium values, ranging from a maximum of 54,500 tons in 1958 to a minimum of 22,350 in 1973 (Fig. 2). The fishing effort during these years, expressed in days fished, exceeded notably the level of f (MSY) suggested by the computations, with the exception of the year 1973 where it was close to the theoretical value. The standardized CPUE had only slight variations during these years, with the exception of 1965 when it fell to a level of 9.4 tons per days fished.

Due to the unavailability of adequate data in length frequencies and age composition of commercial catches, it is not possible to determine by any method the composition of the population, the recruitment, and its characteristics, and to establish catch quotas at an optimum or adequate level of fishing mortality. However, taking into account the trends of CPUE of effort and catch during the last few years, it is considered that a TAC of redfish near to 16,000 tons in Div. 3M will not affect the recovery of the redfish stock as is shown by the CPUE values.

Acknowledgements

We are grateful to Dr R. Coyula and Mr A. Pérez for their assistance in the revision and translation of this paper respectively.

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Table 1. Summary of determined parameters of the production model.

Method	Year average	(r)	MSY tons	f(MSY) days fished	CPUE(MSY) tons per day fished
Schaefer-Gulland	6	0.8334	16,000	1,000	16.0
Schaefer-Gulland	8	0.7573	16,700	1,000	16.7
Schaefer-Gulland & Walter's method	6	0.9449	16,500	1,000	16.5

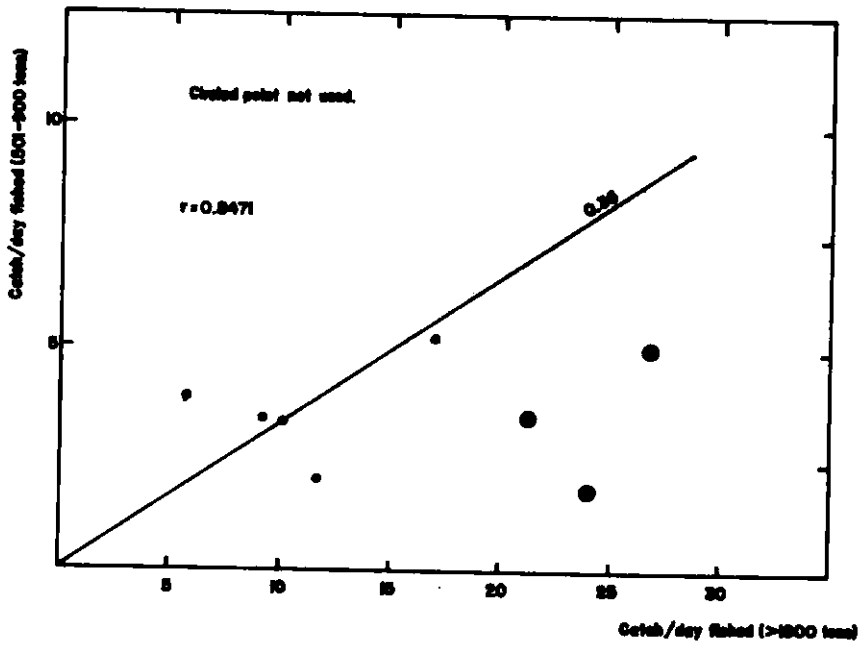

Fig.1-Catch per day fished of vessels 151-500 tonnage categories versus catch per day fished of vessels in tonnage category >1500 tons, redfish, div. 3M.

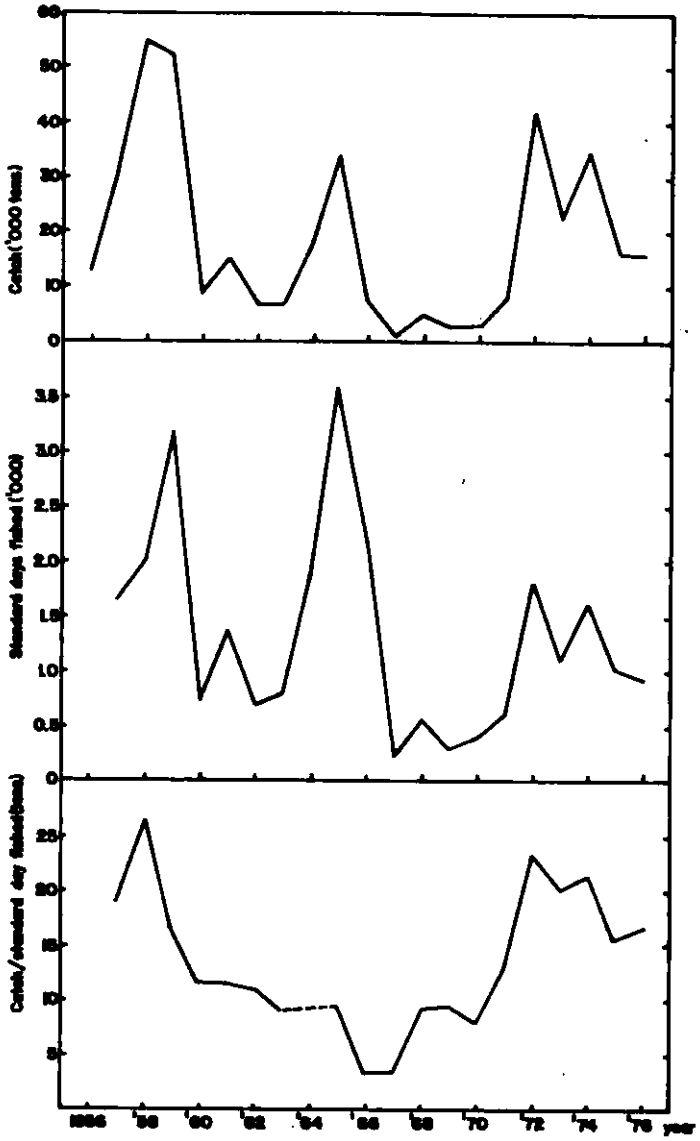

Fig.2 - Trends in nominal catch, effort and catch per unit effort in standard trawler units - vessels over 1600 tons - for redfish in div. 3M.

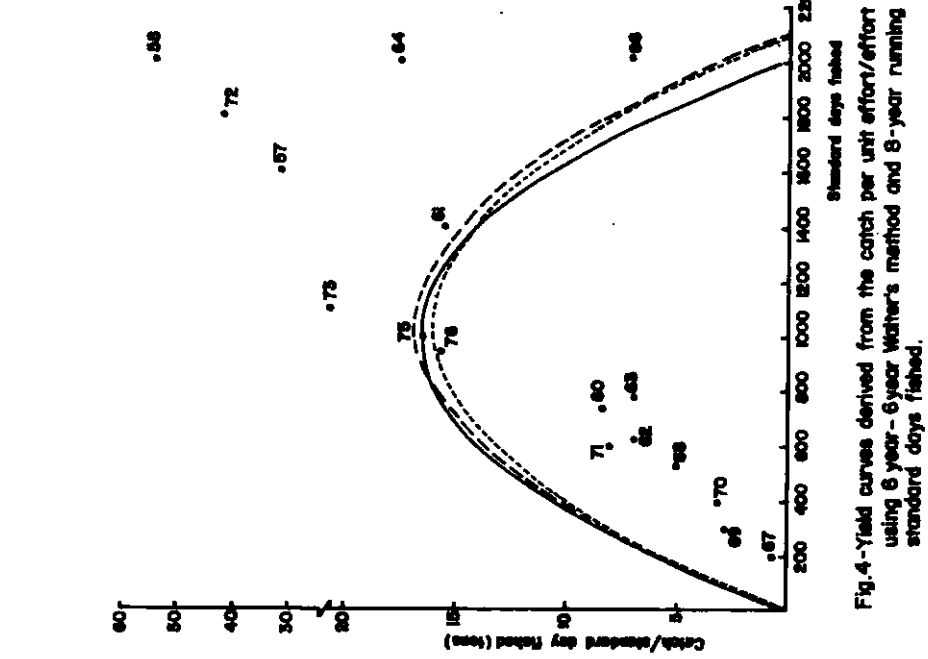

Fig.4-Yield curves derived from the catch per unit effort/effort relationship, using 6 year-6 year Walter's method and 8-year running averages of standard days fished.

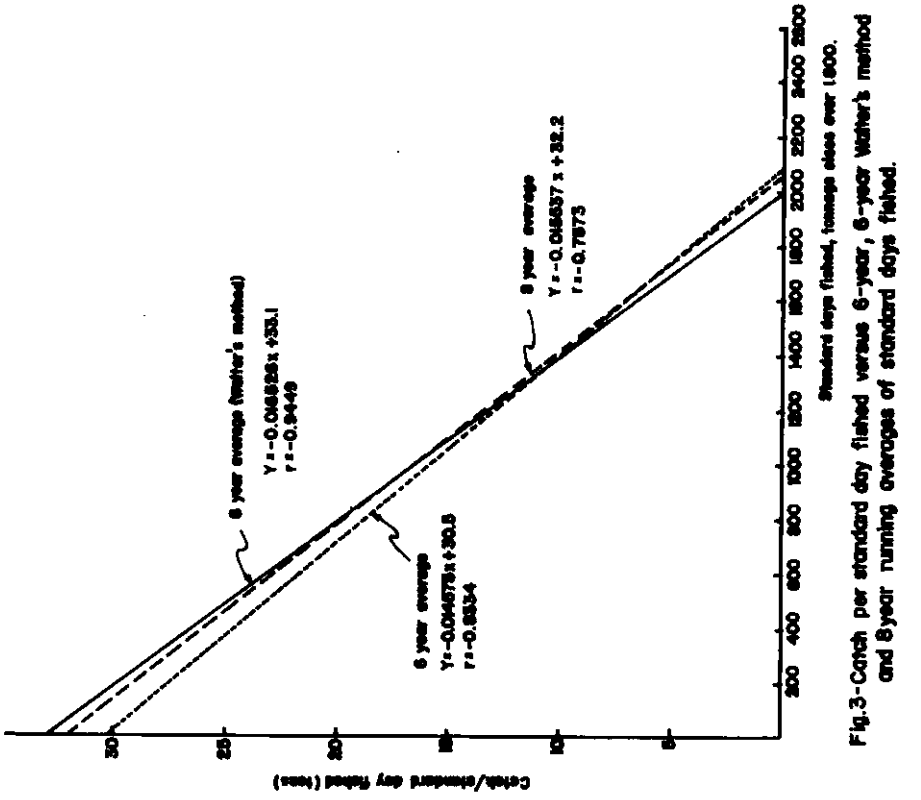

Fig.3-Catch per standard day fished versus 6-year, 6-year Walter's method and 8-year running averages of standard days fished.